CLAIMS

1. Tube resistant to stress-cracking and forming a water barrier, essentially consisting of a flexible skirt (1) elongate in an axial direction (XX') and of a head (2), comprising at least one evacuation orifice (3) and a neck (4) forming a radial extension of the orifice (3) and being joined to the skirt (1) along an axial direction (XX'), at least the skirt and neck forming a single-piece assembly, the wall of the tube consisting of a mixture of a number "n" at least equal to 1 of polymers belonging to the family of copolymers-olefins prepared from C_2 to C_{10} monomers, characterized:

- in that, at mid-distance of its length (H) along the axial direction (XX') from the end (121) of the skirt (1) distant from the head as far as the end (123) of the neck (4) forming the evacuation orifice (3), it has a wall thickness of between 0.30 and 1.00 mm,

- in that at least one polymer of the mixture belongs to the polypropylene family,

- in that the constituent mixture of the tube wall has a flexural modulus of between 700 MPa and 80 MPa, preferably between 500 MPa and 120 MPa according to standard NF EN ISO 178, and

- in that, each polymer having a flexural modulus defined according to standard NF EN ISO 178 and being conventionally assigned a rank "i" which, in a classification of the "n" polymers of the mixture in decreasing order of their respective flexural modulus values μ_i, places this polymer between a first polymer (i=1) of maximum rigidity and a last polymer (i=n) of minimum rigidity, and each polymer being contained in the mixture in a weight percentage x_i with respect to the total weight of the mixture, the mixture has a dispersion factor (Kd) of the flexural modulus values of no more than 3 or 2.2 according to whether or not it contains a polyethylene, preferably no more than 2 in both these cases, and further preferably no more than 1.5, this dispersion factor (Kd) being defined as:

$$Kd = \sum_{i=1}^{n} \left[\left(\left(\sum_{j=1}^{i-1} x_j\right) . (\nu_{1,i-1} - \nu_{1,i})^2 + x_i . (\lambda_i - \nu_{1,i})^2 \right) / \nu_{1,i}^2 \right],$$

in which:

$$\lambda_i = \mathrm{MAX}\,(\mu_i, 1500\ \mathrm{MPa}),$$

and in which:

$$\nu_{p,q} = \left(\sum_{i=p}^{q} x_i . \lambda_i\right) / \left(\sum_{i=p}^{q} x_i\right).$$

2. Tube as in claim 1, characterized in that the first polymer is a copolymer of propylene and ethylene.

3. Tube as in any of the preceding claims, characterized in that the first polymer is a heterophase polypropylene copolymer of propylene and ethylene.

4. Tube as in any of the preceding claims, characterized in that the most rigid polymer has a flexural modulus of no more than 850 MPa, with the result that the mixture forming the tube wall has a strong water barrier.

5. Tube as in any of the preceding claims, characterized in that the first polymer has a flexural modulus of no more than 500 MPa.

6. Tube as in any of the preceding claims, characterized in that the mixture comprises at least one second polymer.

7. Tube as in claim 6, characterized in that the second polymer has a flexural modulus greater than 70 MPa, and in that this second polymer is contained in the mixture to a proportion of 15% to 85%, preferably between 25% and 75%.

8. Tube as in claim 6, characterized in that the second polymer has a flexural modulus of less than 70 MPa, and in that this second polymer is contained in the mixture to a proportion of less than 50%, preferably between 15% and 40%.

9. Tube as in any of claims 6 to 8, characterized in that the second polymer is a linear C_4-C_{10} copolymer of ethylene-olefin, this second polymer having a melt flow index (MFI) measured according to standard ISO 1133 of between 3g/10mn and 15g/10mn, preferably between 4g/10mn and 12g/10mn.

10. Tube as in any of claims 6 to 9, characterized in that the second polymer is a copolymer of ethylene-octene.

11. Tube as in any of claims 6 to 8, characterized in that the second polymer is a polypropylene.

12. Tube as in any of claims 6 to 8, characterized in that the second polymer is a heterophase copolymer of propylene and ethylene.

13. Tube as in any of the preceding claims, characterized in that the first and optionally the single polymer has a flexural modulus of less than 250 MPa for a tube capacity of at least 30 ml.

14. Tube as in any of the preceding claims, characterized in that any polymer of the polypropylene family entering into the wall composition mixture has a melt flow index (MFI) measured according to standard ISO 1133 of no more than 100g/10mn, preferably no more than 20g/10mn.

15. Tube as in any of the preceding claims, characterized in that the length (H) is between 40 and 85 mm.

16. Tube as in any of the preceding claims, characterized in that the length (H) is between 85 and 200 mm.

17. Tube as in any of the preceding claims, characterized in that it is obtained by injection into an injection mould comprising a core (6) and an impression (7), the core itself comprising a central part (10) of which one free end (11) centre-bears upon the impression (7) at least during the injection phase of the tube skirt.

18. Tube as in claim 17, characterized in that the free end (11) of the central part (10) of the core comprising supply channels (12), at its injection end (122) it has an apex wall formed at least in part of sectors (32) corresponding to the supply channels (12).

19. Tube as in claim 18, characterized in that the accumulated widths of the sectors (32), in the zones (18) where they join with the face (29) parallel to the axial direction (XX') of the orifice (3), represent at least 15%, preferably more than 25%, of the perimeter of the face (29).

20. Tube as in any of the preceding claims combined with claim 19, characterized in that the sectors (32) have a width which increases from an injection point (15) of the mould along a centrifugal radial direction as far as the joining points (18) of the sectors with the face (29) of orifice (3).

21. Tube as in any of the preceding claims combined with claim 17, characterized in that the wall of orifice (3) has an annular throttle zone (Z) located beyond sectors (32).

22. Tube as in any of claims 17 to 21, characterized in that the wall of orifice (3) is extended by a ring of material (W) positioned in a plane perpendicular to axis XX', under end (123) of the neck.

23. Tube as in any of claims 17 to 22 combined with claim 17, characterized in that the central part (10) of core

(6) of the injection mould is mobile, and in that the apex wall of the tube end (122) is formed with no gaps by drawing backwardly the mobile central part (10) over a distance corresponding to the desired thickness of this apex wall.

24. Tube as in any of claims 17 to 23, combined with claim 23, characterized in that the free end (11) of the central part (10) of the core is in the shape of a sunken cone, the angle (γ) formed by the bearing surface of this free end (11) on impression (7) with the plane perpendicular to the longitudinal axis (XX') of the tube lying between 15° and 45°.

25. Tube as in claim 24, characterized in that the angle (γ) lies between 15° and 20°.

26. Tube as in any of claims 17 to 23, combined with claim 23, characterized in that the free end (11) of the central part (10) of the core is in the shape of a projecting cone frustum, the angle (β) formed by the bearing surface of the projecting cone frustum of this free end (11) on impression (7) with the plane perpendicular to the longitudinal axis (XX') of the tube lying between 35° and 45°.

27. Tube as in claim 26, characterized in that the free end (11) of the central part (10) of the core is in the shape of a sunken cone in its part internal to the projecting cone frustum, the angle (δ) formed by the bearing surface of the sunken cone of this free end (11) on impression (7) with the plane perpendicular to the longitudinal axis (XX') of the tube being less than 45°, preferably between 15° and 20°.

28. Tube as in any of claims 17 to 27 combined with claim 23, characterized in that the head comprises single-piece securing means of nozzle type (5), and a single-piece reducer (9), the nozzle and reducer being positioned in the continuation of orifice (3) along axis XX', the apex wall (122) of the nozzle forming reducer (9), the reducer orifice

(8) being obtained by cutting after injection-forming the tube, the tube, nozzle and reducer thereby forming a single-piece assembly formed by injection in a single operation.

29. Tube as in any of the preceding claims combined with claim 28, characterized in that it is provided with capping means (35) provided with a tip (27) of conical shape, in that the tip enters into the orifice (8) of the single-piece reducer (9), in that the tip places the wall of the reducer (9) under centrifugal radial tension (25) in the vicinity of the opening orifice (8).

30. Tube as in any of claims 17 to 27, characterized in that the head comprises single-piece securing means of nozzle type (5) positioned in the continuation of orifice (3) along axis XX', the tube and the securing means (5) forming a single-piece assembly formed by injection in a single operation.

31. Tube as in any of claims 28 or 30, characterized in that the wall of the single-piece nozzle (5) carries an asymmetric thread (19).

32. Tube as in any of claims 1 to 27, 30 and 31, characterized in that it is provided with an added accessory of dispensing type of added reducer type (36) or added nozzle tip type, or securing means of added nozzle type forming a reducer (37) or nozzle tip, or capping means of service cap type (38), the added accessory being positioned in the continuation of orifice (3) along axis XX'.

33. Tube as in claim 32, characterized in that the added accessory (36), (37) or (38) is provided with a chimney (21) of which an outer face is conjugated with the face (29) parallel to axis XX' of orifice (3), after inserting the chimney (21) inside the orifice (3).

34. Tube as in claim 33, characterized in that the chimney (21) of the added accessory places the wall of orifice (3) under centrifugal radial tension (25).

35. Tube as in claim 33, characterized in that the added accessory is non-removable and in that the chimney (21) of the added accessory is fitted with a penetration device of conical shape (22), the outer face of the chimney being radially recessed (23) with respect to the penetration device (22).

36. Method for fabricating a flexible tube consisting of a skirt and head comprising at least one evacuation orifice and a neck forming a radial extension of the orifice and being joined to the skirt, at least the skirt and neck forming a single-piece assembly resistant to stress-cracking and forming a water barrier, characterized in that it comprises the steps consisting of:

- using as constituent material of the wall a mixture of a number "n" at least equal to 1 of polymers belonging to the family of copolymers-olefins prepared from C_2 to C_{10} monomers, at least one polymer belonging to the polypropylene family, the constituent mixture of the wall having a flexural modulus of between 700 and 80 MPa, preferably between 500 and 120 MPa according to standard NF EN ISO 178; and of

- fabricating the skirt and head of the tube by injecting the mixture, in a single injection operation, into an injection mould comprising an impression (7) and a core (6), said core comprising a central part (10) of which one free upper end (11) centre-bears upon the impression (7) at least during the skirt injection phase.